Yo-Yo Machines: Self-Build Peripheral Awareness Communication Devices

INTERACTION RESEARCH STUDIO

Yo–Yo Machines are playful communication devices designed to help people feel socially connected while physically separated. Our response to a UK call for projects using previous research to make impact during the pandemic, they make a long line of work on peripheral and emotional awareness available to the public in the form of devices they can build themselves at home. By following simple online instructions (**yoyomachines.io**), people can build a pair of devices and send one to a friend or loved one – the devices are connected by the internet allowing simple communication at a distance.

Yo-Yo Machines complement Zoom or telephone calls by giving a frequent and casual feeling of presence. For instance, **Light Touch** lets you send slowly fading coloured lights to each other over the internet. Bill Gaver, co-director of the studio, has been using a pair with his 92-year-old mother for about 9 months now. "They're surprisingly compelling — when she sends me a light from California it feels like she's right next to my desk in London. It's also really nice when I wake up or return home and find a light she's sent earlier, and she says she looks for a light from me particularly when she gets up at night."

Speed Dial is like a mood barometer that you share with a friend or family member. Move the pointer to indicate your choice from a set of options, and your partner can respond with theirs. Different dials give different options — use one of ours or make your own: you can be as serious or silly as you want.

Knock Knock lets you send tapping sounds between devices. Knocking on one causes an identical knocking sound on the other, even if it's halfway around the world. Use them to attract attention, say hello, or play elaborate rhythm games: they're a simple and immediate way to create a moment of connection.

Flutter By are gentle communicators that use motion sensors to pick up activity in one place and signal it in another – like curtains swaying when someone walks by on the other side. You don't need to press any buttons to operate them: just set them running and they'll do their thing, creating a sense of social connection between distant spaces.

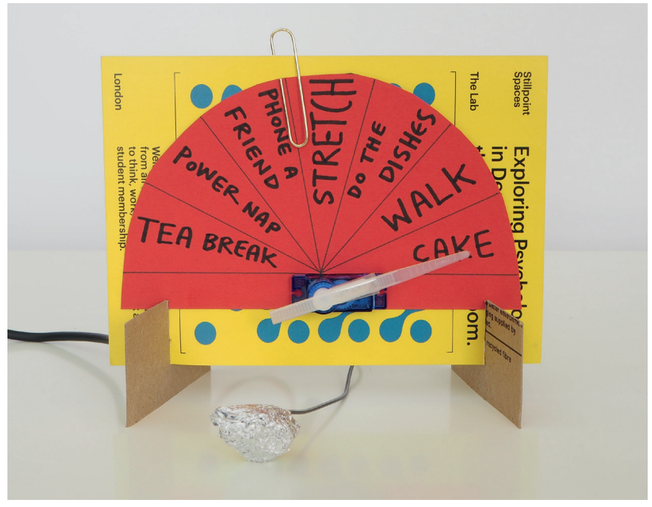
Based on the low-cost ESP32S microcontroller, Yo-Yo Machines are cheap and easy to make (around £25 a pair), requiring only a small breadboard, jumper leads and design-specific actuators. Each enclosure is designed to be constructed from everyday household materials without the need for any specialist tools. We created comprehensive step-by-step instructions using a web platform created by Dozuki, which guides users through each stage and aims to help the most novice maker complete the build without 'getting stuck'. With this philosophy in mind, we developed software that is straightforward to install by creating our own firmware uploader that manages the complete boot-loading process. In addition, a dedicated captive portal manages WiFi credentials for both the host device and if necessary, the remote device, allowing a pair to be constructed in one space and the remote unit to be mailed so that it will connect straight out of the box.

Opposite: Jellyfish and Moon Plate versions of Light Touch. The devices are controlled by capacitive touch, in these versions using scrunched tinfoil and a bulldog clip.

Left: A Speed Dial made from a cereal box and controlled with a spoon, featuring a dial wheel with the seven sins.

Below Right: A mini Speed Dial with postcard-sized dials that can be easily swapped in coordination with the remote user.

Below Left: Paired Speed Dials. People can mix and match the suggested enclosure designs, or create their own.

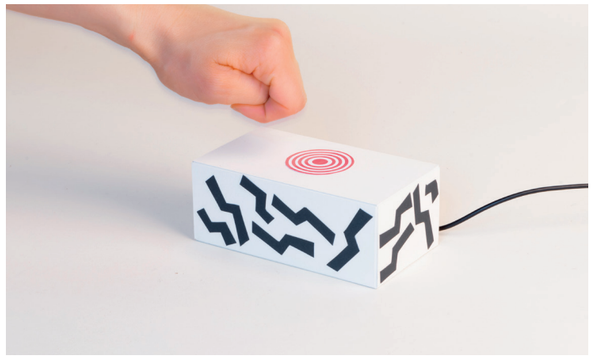


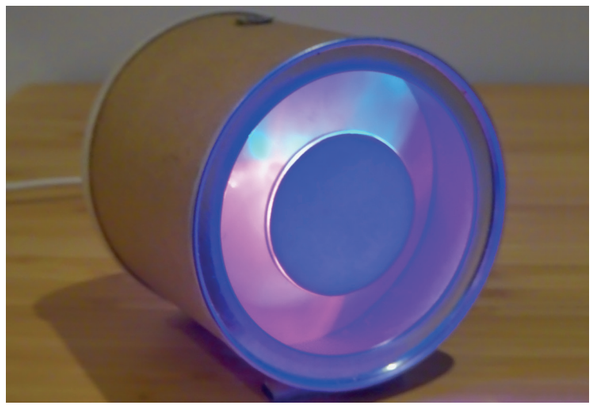
The project builds on at least 30 years of research into systems that support peripheral and emotional awareness remotely (see **www.yoyomachines.io/history**). Numerous designs for simple communication devices have been suggested during that time, but with a few notable exceptions few have actually been implemented to work over a distance, and even fewer have been used by people in their everyday lives. With the advent of inexpensive and powerful microprocessor technologies, and within the context of physical distancing necessitated by the pandemic, Yo–Yo Machines are affordable devices that people can really make and use in their own homes to feel connected with one another.

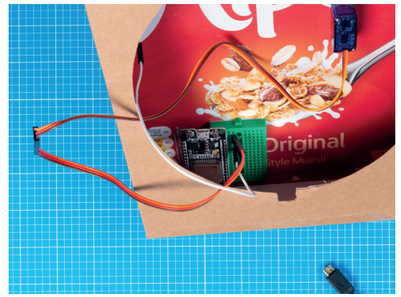
Below Left & Right: Variations of Knock Knock. The device is constructed using a piezo sensor and small solenoid which affords great adaptability in the housing, allowing people to build Knock Knock's from a variety of materials ranging from phone boxes and Amazon parcels to jam jars.

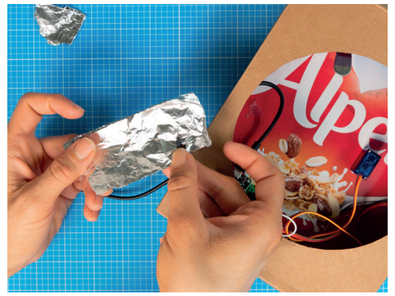
Bottom Left: Bill's mother with her Light Touch in California.

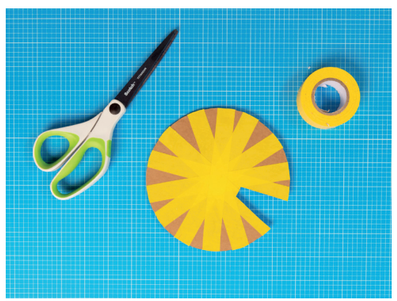
Bottom Right: Bill's Light Touch in London. An internal divider mounted in an empty nut container hides the electronics and holds the LEDs. A small mirror reflects the lights back into the enclosure, allowing the colours to concentrate and mix.

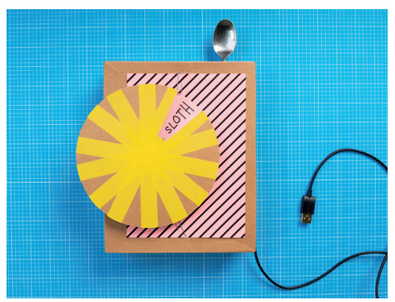












Opposite & Above. A selection of making stages taken from the online instructions for the cereal packet version of the Speed Dial. Each stage is richly illustrated and described, with explanatory links provided for any technical jargon as well as information about all the parts and tools required to complete the build.

Below: Flutter By Feather. A small, passive infrared sensor detects movement and signals the paired device to spin a small motor connected to paper feathers inside the upturned pickle jar. Flutter By devices are unique in the Yo-Yo Machines collection for their passively interactive form of peripheral communication.

The **Interaction Research Studio** uses design-led methodologies to explore innovative technologies for everyday life. Their practice-based research integrates design-led research methods with work on embedded and ubiquitous technologies to produce prototype products embodying new concepts for interaction. The Studio's designs create situations rather than solving problems, encouraging playfulness, exploration and insight in a wide variety of domains.

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